

## CLAIMS

### WHAT IS CLAIMED IS:

- 5           1.       A method of creating a molecular profile of a chemical composition, comprising the steps of:
- a) contacting an isolated population of mammalian mesenchymal stem cells (MSCs) with the chemical composition; and
- b) recording alterations in gene expression or protein expression in the  
10       mammalian MSCs in response to the chemical composition to create a molecular profile of the chemical composition.
2.       A method of compiling a library of molecular profiles of chemical compositions having predetermined toxicities, comprising the steps of:
- 15           a) contacting an isolated population of mammalian mesenchymal stem cells (MSCs) with a chemical composition having predetermined toxicities;
- b) recording alterations in gene expression or protein expression in the mammalian MSCs in response to the chemical composition to create a molecular profile of the chemical composition; and
- 20           c) compiling a library of molecular profiles by repeating steps a) and b) with at least two chemical compositions having predetermined toxicities.
3.       The method of claim 1 or 2, wherein the alterations in gene expression or protein expression are detected by a label.
- 25           4.       The method of claim 3, wherein the label is selected from the group consisting of fluorescent, colorimetric, radioactive, enzyme, enzyme substrate,

nucleoside analog, magnetic, glass, latex bead, colloidal gold, and electronic transponder.

5            5.        The method of claim 1 or 2, wherein the molecular profile comprises alterations in gene expression.

6.        The method of claim 5, wherein the alterations in gene expression are detected by a nucleotide hybridization assay.

10           7.        The method of claim 1 or 2, wherein the molecular profile comprises alterations in protein expression.

15           8.        The method of claim 7, wherein the alterations in protein expression are detected by an immunoactivity assay.

9.        The method of claim 7, wherein the alterations in protein expression are detected by a mass spectrometry assay.

20           10.       The method of claim 2, wherein the MSCs are of human.

11.       The method of claim 10, further wherein the chemical compositions having predetermined toxicities are selected from the group consisting of therapeutic agents, neurotoxins, renal toxins, hepatic toxins, toxins of hematopoietic cells, and myotoxins.

25           12.       The method of claim 10, further wherein the chemical compositions having predetermined toxicities are selected from the group consisting of agents that

are toxic to cells of one or more reproductive organs, teratogenic agents and carcinogens.

5           13.     The method of claim 10, further wherein the chemical compositions having predetermined toxicities are selected from the group consisting of agricultural chemicals, cosmetics, and environmental contaminants.

10           14.     The method of claim 2, wherein the MSCs are of non-human mammals.

15           15.     The method of claim 14, wherein the non-human mammals are rodents.

20           16.     The method of claim 14, further wherein the chemical compositions having predetermined toxicities are selected from the group consisting of animal therapeutics, neurotoxins, renal toxins, hepatic toxins, toxins of hematopoietic cells, and myotoxins.

25           17.     The method of claim 14, further wherein the chemical compositions having predetermined toxicities are selected from the group consisting of agents that are toxic to cells of one or more reproductive organs, teratogenic agents and carcinogens.

          18.     The method of claim 14, further wherein the chemical compositions having predetermined toxicities are selected from the group consisting of agricultural chemicals, cosmetics, and environmental contaminants.

19. A library of molecular profiles of chemical compositions having predetermined toxicities, produced by a method according to any one of the claims 2, 10-18.

5           20. The library of claim 19, wherein the library comprises molecular profiles for at least 20 chemical compositions.

21. A method of typing toxicity of a test chemical composition, comprising the steps of:

10                   a) creating a molecular profile of the test chemical composition according to claim 1; and

                  b) comparing the molecular profile in step a) with the molecular profile of a chemical composition having predetermined toxicities;

15                   wherein the type of toxicity of the test chemical composition is determined by the comparison in step b).

22. A systematic method of typing toxicity of a test chemical composition, comprising the steps of:

20                   a) creating a molecular profile of the test chemical composition according to claim 1; and

                  b) comparing the molecular profile in step a) with a composite library of molecular profiles of chemical compositions having predetermined toxicities, wherein the composite library comprises the molecular profiles of at least two chemical compositions, said molecular profiles are created according to claim 1;

25                   wherein the type of toxicity of the test chemical composition is determined by the comparison in step b).

23. A method of ranking toxicity of a test chemical composition, the method comprising:

a) creating a molecular profile of the test chemical composition according to claim 1; and

5 b) comparing the molecular profile in step a) with a composite library of molecular profiles of chemical compositions having predetermined toxicities, wherein the composite library comprises the molecular profiles of at least two chemical compositions, said molecular profiles are created according to claim 1; wherein the toxicity of the test chemical composition is ranked by the  
10 comparison in step b).

24. The method of claim 21, 22 or 23, wherein the test chemical composition is known or unknown.

15 25. The method of claim 21, 22 or 23, further wherein the MSCs are of human.

26. The method of claim 25, further wherein the chemical compositions having predetermined toxicities are therapeutic agents, neurotoxins, renal toxins,  
20 hepatic toxins, toxins of hematopoietic cells, or myotoxins.

27. The method of claim 25, further wherein the chemical compositions having predetermined toxicities are selected from the group consisting of agents that are toxic to cells of one or more reproductive organs, teratogenic agents and  
25 carcinogens.

28. The method of claim 25, further wherein the chemical compositions having predetermined toxicities are selected from the group consisting of agricultural chemicals, cosmetics, and environmental contaminants.

5 29. The method of claim 21, 22 or 23, further wherein the MSCs are of non-human mammals.

30. The method of claim 29, wherein the non-human mammals are rodents.

10 31. The method of claim 29, further wherein the chemical compositions having predetermined toxicities are selected from the group consisting of animal therapeutics, neurotoxins, renal toxins, hepatic toxins, toxins of hematopoietic cells, and myotoxins.

15 32. The method of claim 29, further wherein the chemical compositions having predetermined toxicities are selected from the group consisting of agents that are toxic to cells of one or more reproductive organs, teratogenic agents and carcinogens.

20 33. The method of claim 29, further wherein the chemical compositions having predetermined toxicities are selected from the group consisting of agricultural chemicals, cosmetics, and environmental contaminants.

25 34. An integrated system for comparing the molecular profile in MSCs of a chemical composition to a library of molecular profiles in MSCs of chemical compositions having predetermined toxicities, comprising: an array reader adapted to read the pattern of labels on an array, operably linked to a digital computer

comprising a database file having a plurality of molecular profiles in MSCs of chemical compositions having predetermined toxicities.

5           35.     The integrated system of claim 34, wherein the data file comprises at least 20 gene or protein expression profiles.

          36.     The integrated system of claim 34, capable of reading the hybridization pattern of 500 or more labels on an array per hour.

10           37.     The integrated system of claim 34, further operably linked to an optical detector for reading the pattern of labels on an array.

          38.     An integrated system for correlating the molecular profile in MSCs and toxicity for a chemical composition comprising: an array reader adapted to read  
15     the pattern of labels on an array, operably linked to a digital computer comprising a database file having a plurality of molecular profiles in MSCs of chemical compositions with predetermined toxicities and a program suitable for molecular profile-toxicity correlation.

20           39.     The integrated system of claim 38, wherein the data file comprises at least 20 gene or protein expression profiles.

          40.     The integrated system of claim 38, capable of reading the hybridization pattern of 500 or more labels on an array per hour.

25           41.     The integrated system of claim 38, further operably linked to an optical detector for reading the pattern of labels on an array.